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COMMERCIAL TISSUE CULTURE

TECHNO MARKET STUDY
AND
PROJECT ECONOMICS

Prepared by

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NEW DELHI

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COMMERCIAL TISSUE CULTURE

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PREFACE

Biotechnology and environment are phenomena of great consequence and big potential in today's world. These two, between them, are destined to bring about a transformation in the developmental scenario of the world during the coming decades.

As for biotechnology, there is no limit to its growth, be it in tissue culture, hybrid seeds or aquaculture, pharmaceuticals, diagnostics or enzymes, processed food, beverages or chemicals, or even in waste treatment, or hi-tech DNA culture. It is true that the advanced world has progressed much beyond India in these areas, but then, we have also started taking quite a few determined steps in recent years.

The Department of Biotechnology, under the Ministry of Science and Technology, has been spearheading the planning, promotion and coordination of programmes in biotechnology. Biotech Consortium India Ltd. (BCIL) is a pivot in the scenario and works as a facilitator for commercialisation of biotech research and biotech products in both agriculture and industry. One major activity of BCIL in this context is the promotion of studies and research in biotechnology. The present status report is the outcome of one such venture, and is in fact one in a series of similar studies and status reports.

We had commissioned Dr. (Mrs.) S. Leelavathi of Microplantech, New Delhi to undertake the study. We appreciate the work done by Microplantech.

In the production of the status reports of BCIL, I have the pleasure to acknowledge the guidance of Dr. S. K. Ray, Principal Editor and Adviser.

New Delhi
8 August, 1994

S. Chandrasekhar

PROLOGUE

The value of tissue culture in agriculture, forestry and commercial crops are too well known to be repeated here. The elite amongst farmers realize that tissue culture in addition to bringing about a very fast seed multiplication also helps in disease free, pest free and uniform crops. The importance of tissue culture can be gauged from the fact that United Nations projections estimate that 75% of all the major seeds in next century may be developed by genetic engineering or tissue culture. Markets for biotech products spread in developing countries by the middle or end of the decade. In the 12 leading agricultural based countries, the retail value of biotech derived seed for 10 principal crops is forecast to grow form $ 165 million in 1990 to $ 1.5 billion by 1995 and to $ 5.9 billion by 2001. The favourable atmosphere for the expansion of application of tissue culture methods to Indian conditions is indicated by the enthusiasm with which large companies including multinationals are entering the field. This is no cause for panic or anxiety for small professionals. To quote Martin T. Glucas, Leicestershire, U.K. "It has been suggested that to be viable, a multinational player today needs sales in excess of $ 250m; by the turn of the century, three times that may be the bench mark. At the other end of scale there appears no reason why smaller companies, provided they are well managed and "light on their feet" should not continue to prosper. Focussing on national, regional and niche markets in carefully selected crops allows plenty of scope for dedicated professionals. Quality germplasm and market relevant plant breeding methods seems likely to remain the foundation stone of prosperity in the industry for some time".

Further the number of small exports in floriproducts all the world over is increasing e.g. the number of exporters doing less than 0.1 m dfl p.a. in The Netherlands auctions is increasing since 1980. It stood at 1251 business units in 1984 (CBI Report on Market for floricultural products in Netherlands) each valued at less than even 1000 dfl. to Netherlands and other European countries in turnover p.a.

In this context the opinion expressed by U.K. experts Robin D Rice, Peter G Alderson etc., in their esteemed article "Micro propagation - Principles and commercial practice" is noteworthy: "Eventually the predominance in micropropagation may shift to the third world, thereby mirroring trends in many manufacturing industries."

S. Leelavathi

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TISSUE CULTURE TECHNOLOGY

INTRODUCTION

Micropropagation has become one of the most beneficial ways to produce crops that are difficult to propagate by conventional methods like cutting or seed. For instance the application of tissue culture techniques to produce virus free plants of Cymbidium orchids initially led to subsequent micropropagation of a great diversity of plants in vitro. Presently European countries and USA produce hundreds of micropropagated plants of which above 55% are orchids.

Micropropagation has two distinct uses : 1. rapid clonal propagation and 2. Establishment, maintenance and distribution of pathogen resistant tested clones. It is analogous in many ways to conventional propagation and must compete for recognised horticultural markets. Its application for all the crops is not effective because they cannot compete with seed cuttings cost-wise. At present the micropropagation is limited to only some crops due to cost-competitiveness.

ADVANTAGES OF MICROPROPAGATION

Micropropagation has several advantages over conventional methods of propagation.

1. Rapid multiplication: Micropropagation offers a rapid multiplication of plant material and is very useful in development and release of both asexually (through cuttings) and sexually propagated (through seed) varieties. It increases the valuable genotypes and new selections. It can cut down time by rapid increase of parental lines, by which a hybrid variety could be released 3 or 5 years earlier compared to the normal time required by utilizing stock seed increase of plants.
2. Small pieces of plants (explants) can be used to produce a large number of plants in a small space.
3. Product uniformity: Micropropagation provides a high degree of phenotypic uniformity. As the production cycle takes place under artificial conditions crop scheduling is easier to control. The resulting product has a very high degree of uniformity as compared with that produced by other propagation methods.
4. Germplasm storage: Plantlets can be stored in vitro in a small space and less labour is required for maintenance of stock plants.
5. Plantlets produced are usually free of bacteria and fungi, and in some cases plantlets can be free of viruses by treatment.
6. Nutrient levels, light, temperature and other factors can be more readily controlled to accelerate vegetative multiplication and regeneration.
7. In most cases micropropagation is independent of seasons. This potential is especially valuable when one considers international markets, particularly reversed seasons of the northern and southern hemisphere. As the micropropagation could be carried out throughout the year, production cycles can be scheduled to meet peak demands. In addition, the ability to cold-store cultures further contributes to defining production schedules.
8. Plants in vitro require minimal attention between subcultures. Therefore, no labour and materials for watering, weeding, spraying etc. are needed.

   Eg. In conventional propagation lot of labour and materials like chemicals to control pests, weeds are used before the young seedlings are transplanted into the green house. In micropropagation once subcultured the plants require little care under in vitro conditions. Pesticides and fungicides are hardly required as the plants produced are generally free from any pathogens.

9. Earlier movement of plants: As the micropropagation allows production of disease free material, exchange of plant material in the sterile in vitro conditions greatly speeds inspection at international entry points and it eases the greater exchange of materials from countries where the cost of production is low to expanded markets.

LIMITATIONS OF MICROPROPAGATION

1. Micropropagation requires advanced skills, specialized equipment and facilities.
2. The tissue culture derived plants are relatively expensive because of the labour-intensive methods used.
3. Specific methods for getting optimum results with each species must be developed. Currently the choice of crops propagated in labs is limited to the species for which acceptable micropropagation methods are developed. Though there are several reports of propagation methods for each species, they are not applicable to scale up into a commercial scale of production. To be commercially feasible, a successful production protocol must be highly reproducible and acceptable for culture initiation, rapid multiplication, maintenance of high multiplication rate upon numerous subcultures for several years, rooting, acclimatization and reestablishment in soil. If even one or two of the above mentioned requirements cannot be met, the protocol is doomed to fail commercially.
4. Plantlet size is very small initially and the handling becomes difficult.
5. Most commercial labs require a purchase commitment from the customer up to 1 year and a notice of atleast 3 months prior to changes in required quantities, long range planting is necessary for both purchase and production of micropropagated plants.

PRODUCTION TECHNOLOGY

The commercial production of plants by micropropagation is a relatively complicated process that requires many steps or stages. For the convenience of users, the total process is divided into 4 distinct stages. This terminology, referred to as stages I to IV, has been extensively adopted and utilized in the commercial micropropagation industry. Stages I to III occur in vitro and stage IV generally occurs in a green house environment. A separate stage, called, Stage O is also additionally described for commercial micropropagation systems.

The adoption of this production technology greatly simplifies not only the daily operation, accounting and product cost analysis of a commercial production facility but also allows for greater ease in technology.

Stage O: Selection and preparation of mother plants :

This stage emphasizes the importance of healthy stock plants as source of starting material for tissue culture. Plants are grown in green houses with low humidity and no overhead water, avoiding shoots to come in contact with organic potting media etc. thereby reducing the contamination chances several folds.

Stage I : Establishment of asceptic culture :

Cultures can be initiated from any part of the plant, but for commercial micropropagation shoot tips and axillary buds are most often utililzed. Procedures to surface sterilize the explant and induce a healthy growth upon placement of explant have to be standardised for every plant separately.

Stage II : Multiplication of propagule :

In this stage rapid multiplication of organs or structures is undertaken which can give rise to plants. This can be achieved by several procedures such as

1. development of axillary and terminal buds,
2. induction of adventitious shoots or
3. somatic embroyogenesis.

The culture medium formulated should be able to achieve a rapid rate of multiplication. In case of adventitious and axillary shoot multiplication systems, the multiplication rates range from 2 as high as 7 fold. The shoots harvested can be sold at this stage as such or carried on to Stage III.

Stage III : Preparation for reestablishment of plants into soil :

The shoots produced from Stage II can be sometimes transferred directly to soil to be rooted as microcuttings. This possiblity is presently limited to only few plant species at present. For most of the species the shoots have to be rooted in vitro which calls for an additional stage called Stage III. Further, the plants have to be hardened for tolerance to moisture stage stress, resistance to some pathogens, and preparing plants for independent existence from heterotrophic state induced by culture. With certain plants like bulbs, corns, and tubers, it may be necessary to satisfy dormancy - associated reaquirements like chilling etc. This stage requires 1-6 weeks depending on the species.

Stage IV : Transfer to natural environment :

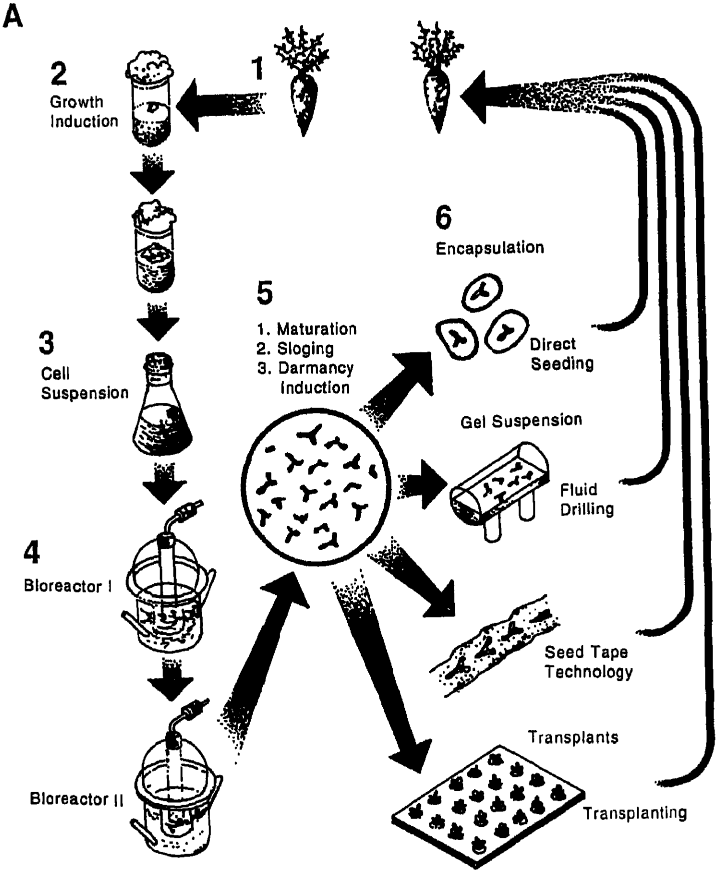
The shoots from stage II or rooted cutting form Stage III are established in soil under controlled greenhouse conditions. Usually a fine particle fog system is employed for successful acclimatization in several species. Complete plants can be established in artificial growing media such as soilless mixes like vermiculite-pete-perlite-sand mixture, rockwool plugs or even sponge. The height of the finished plants range from 3 to 6 inches. Stage IV usually requires 4-16 weeks before the finished product is ready for sale and shipment.

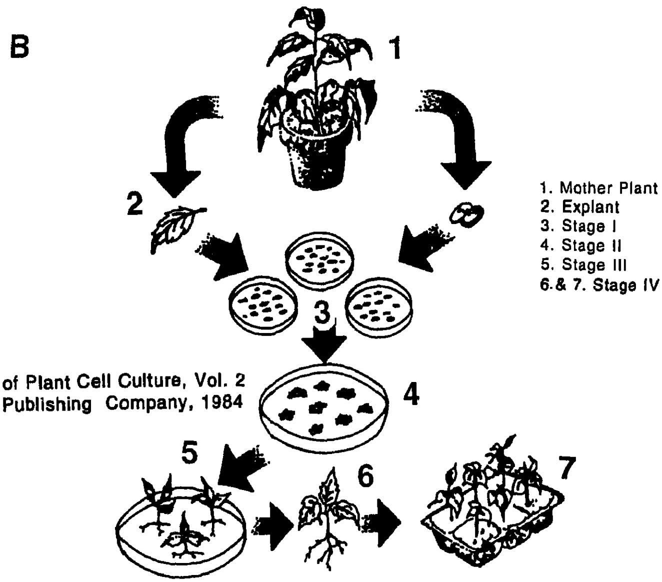
A GENERAL PROTOCOL FOR MICROPROPAGATION

A general protocol showing different stages of micropropagation is given below:

1. Young shoot tip portion of the mother plant is cut with 10-15 cm length. The leaves are removed and the stem is cut into pieces with one or two nodes.
2. Stem pieces are shaken well in water with liquid detergent like Teepol for 5 min and washed several times thoroughly in running water.
3. The stem pieces are sterilized with diluted commercial bleach solution for 15 min or 0.1% mercuric chloride solution fot 20 min.and rinsed with sterile water for 5-6 times. Ten minutes rinsing with sterilized fungicide solution is very useful in eliminating fungus contamination.
4. The sterilized stem pieces are cut at both ends to remove dead tissues and placed on agar medium and kept in light. Shoots appear within 4 weeks.
5. Fresh shoots are cut at the base and subcultured again on the agar based MS medium with combinations of auxin and cytokinin. Within 2-4 weeks axillary shoots start appearing.
6. The whole mass is divided into small pieces and subcultured again on the same medium repeatedly to produce large numbers of axillary buds.
7. For producing shoots, the multiplying mass of axillary shoots is left on the medium.

Tissue Culture Clonal Propagation





Source:
Handbook of Plant Cell Culture, Vol. 2
Macmillan Publishing Company, 1984

8. Each mass with grown shoots is cut into 4-6 pieces with 8-10 shoots and subcultured on to rooting medium usually containing an auxin.
9. Roots develop within 4 weeks and shoots elongate to 3-4cm. Plants are separated from each other and kept in high humidity for few days.
10. Plants are transferred gradually to shaded greenhouse.

REQUIREMENT OF MICROPROPAGATION LABORATORY

The success of a commercial micropropagation business mainly depends on the design and location of the facility. Several factors that influence the micropropagation, are the specialised areas and equipment for culture media preparation, sterilization and storage, dish washing, culture initiation, growth and subculture, cold storage, planting, acclimatization, and establishment, packing and shipping.

Location of laboratory:

When a new facility is to be built, the location should be chosen carefully. It should be nearest to the marketing areas and the Stage IV product should be readily acclimatized to the ultimate environment where it is going to be planted. This is particularly true with plantation crops like cardamom, banana, etc. Further if the target of the product is international market, it should be as near and accessible to international airport as possible. In our country it is better to start the laboratories near the big cities to facilitate faster and easier availability of labour, chemicals, and servicing of machinery.

Building Plans:

The building plan is very important in controlling accurate temperature, especially in growth rooms and airflow filtration systems to maintain clean environments in the growth rooms and laminar flow areas. The design should be such that minimum possible sources of contamination occur in the production areas. The least clean areas of the operation like packing and shipping from greenhouse and lab should be as distant as possible from to minimize contact and avoid contamination. The lab should be left with space to further expansion easily.

Media preparation:

Large quantities of media should be effectively produced. It includes pure distilled or deionized water. Whichever water is used, it should be uniform and same throughout the years. Balances, pH meter, refrigerator, mixing tank and stirrer, adequate counter and storage space, and culture media dispensing apparatus are needed. Once prepared the media is steam sterilized in autoclaves and later transferred to laminar flow area or media storage area. There should be a washing area nearby with a drying facility like oven.

Transfer area:

Transfer area with laminar flow should be designed with great care to minimize contamination. The laminar flow hoods should be checked on regular basis and prefilters should be cleaned. Forceps and scalpels should be on regular sterilized basis with electrically heated ceramic tubes filled with glass beads. Flame sterilization with alcohol is best avoided due to fire and safety hazard. Good air-conditioning is needed in this area. Carts are used for easier movement.

Table 1 **Formula of Plant Cell Culture Salt Mixtures**

Concentrations in mg/l

INORGANIC SALTS	A 2670	C 1416	G 5768	H 2395	L0270	M 5524	N 5639	P6793	V5630
AluminiumChloride*6H_2O	--	--	--	--	0.05611	--	--	--	--
Ammonium Nitrate	400.0	--	--	--	--	1650.0	720.0	825.00	--
Ammonium Phosphate	--	--	--	115.03	--	--	--	--	500.00
Ammonium Sulfate	--	463.00	134.0	--	1000.0	--	--	500.00	--
Boric Acid	6.2	1.6	3.0	2.86	1.014	6.2	10.0	3.1	--
Calcium Chloride Anhydrous $CaCl_2$	332.2	125.33	113.24	--	--	332.2	166.0	166.0	--
Calcium Nitrate*4H_2O	--	--	--	656.4	347.2	--	--	--	--
Calcium Phosphate Tribase	--	--	--	--	--	--	--	--	200.0
Cobalt Chloride*6H_2O	0.025	--	0.025	--	--	0.025	--	0.0125	--
Cupric Sulfate*5H_2O	0.025	--	0.025	0.08	0.019	0.025	0.025	0.0125	--
Acid, Na_2*2H_2O	74.5	37.3	37.3	--	--	37.26	37.3	37.24	--
Ferric Citrate	--	--	--	--	4.4	--	--	--	--
Ferric Tartrate*2H2O	--	--	--	5.32	--	--	--	--	28.0
Ferrous Sulfate*7H2O	55.7	27.85	27.8	--	--	27.8	27.8	27.85	--
Magnesium Sulfate Anhydrate $MgSo_4$	180.7	90.37	122.09	240.76	58.62	180.07	90.37	90.35	122.1
Manganese Chloride*4H_2O	--	--	--	1.81	--	--	--	--	--
Manganese Sulfate*H_2O	16.9	3.33	10.0	--	0.0515	16.9	18.9	8.45	5.682
Molybdenum Trioxide	--	--	--	0.016	--	--	--	--	--
(Sodium Salt)* 2H_2O	0.25	--	0.25	--	--	0.25	0.25	--	--
Nickel Chloride 6H_2O	--	--	--	--	0.3116	--	--	--	--
Potassium Chloride	--	--	--	--	1050.0	--	--	--	--
Potassium Iodide	0.3	0.8	0.75	--	0.099	0.83	--	0.415	--
Potassium Nitrate	480.0	2830.0	2500.0	606.6	--	1900.0	950.0	950.0	525.0
Phosphate Monobasic	--	400.0	--	--	135.0	170.0	68.0	85.0	250.0
Monobasic Anhydrous	330.6	--	130.5	--	--	--	--	--	--
Zinc Sulfate*7H2O	8.6	1.5	2.0	0.22	0.565	8.6	10.0	5.3	--
Adenine Hemisulfate	--	--	--	--	--	--	--	--	--
6-Benzylaminopurine(BA)	--	--	--	--	--	--	--	2.0	--
MES (Free Acid)	--	--	--	--	--	--	--	1000.0	--
myo-inositol	--	--	--	--	--	--	--	100.0	--
α-Napthaleneacetic Acid	--	--	--	--	--	--	--	0.5	--
Nicotinic Acid (Free Acid)	--	--	--	--	--	--	--	0.5	--
Peptone	--	--	--	--	--	--	--	2000.0	--
Pyridoxine*HCl	--	--	--	--	--	--	--	0.5	0.4
Sucrose	--	--	--	--	--	--	--	20000.0	20000.0
Thiamine*HCl	--	--	--	--	--	--	--	1.0	--

A 2670	Anderson's Rhododendron Basal Salts	C 1416	N6 Basal Salts
G 5768	Gamborg;s B-5 Basal Salts	H 2395	Hoagland's No.2 Basal Salts
L 0270	Lindemann Orchid Basal Salts	M 5524	Murashige and Skoog Basal Salts
N 5639	*Nitsch and Nitsch Basal Salts*	P 6793	Phytamax Orchid Basal Salts
V 5630	Vacin and Went Basal Salts	*	Weight after vacuum drying

Growth rooms:

Cultures are grown in highly controlled environment. Temperature, light intensity, light quality and photoperiod are regulated. The air must be filtered and shelves should permit airflow to facilitate temperature control. Mobile shelves can be installed to maximize the space utilization. Fluorescent lights should not create hot spots on the above shelves. It is better to place the chokes outside the growth room to avoid heat load and ease temperature control. Proper airconditioning to control temperature is of greatest importance.

Green house:

The green house facility is a must for labs going for Stage IV product. It should maintain uniform temperature and high humidity. Great care should be taken for water quality, application of fertilizer, disease and insect control.

Packing and shipping:

Prior to packing and shipping, the plant material is graded and sorted by size. Generally, Stage IV products-finished plantlets are produced in a cell tray format and trays are stacked in shipping boxes. They require special care and insulation against extreme temperatures. Stage II plants are transferred in culture vessels in vitro. Stage IV plants (microcuttings/ unrooted shoots) can be either transported in culture vessels or taken out and washed and packed in small boxes in plastic film maintaining humidity and deaeration. For Stage II and III products, the shipment should be as short as possible compared to Stage IV products.

CONCLUSION

Our country has been very advanced in tissue culture technology for a long time with achievements like first successful anther culture, in vitro pollination etc. However, when it came to application of technology it lagged behind drastically. Only within the past 5-6 years, half a dozen labs from big companies came up. Presently the rush is on to start laboratories all over the country by several companies or individual entrepreneurs. The next decade will see several smaller and larger laboratories coming up successfully which can corner the world market for tissue culture derived plants and floriculture products. There is a tremendous potential for smaller laboratories to come up with specialized products (with 2-3 lakhs pa) and market them indigenously. Mainly fruit trees and ornamental plants and plantation crops have good potential to be marketed in an ever expanding Indian horticulture and floriculture horizon. The growing awareness of Indian farmer is an additional asset in marketing superior quality clones produced by micropropagation, though costlier.

As India's vastly diverse agroclimatic conditions in any season can match with several other countries, plants obtained from any where in the world can be maintained, propagated and transplanted into the soil in India.

The native flora is so rich and divergent, that several new foliage and ornamental plants can be developed and propagated with least competition from outside world.

In India, skilled workers and scientific talent are at par with any other country in the field of tissue culture. Compared to western countries where 40-60% of the cost of a tissue culture plant goes into labour, ours is very low. So our prices can be very competitive and we can make a nice entry into the world market. Hence, there is a lot of scope for several new laboratories to concentrate on export markets or just indigenous markets.

As the finished product can fetch more attractive dividends, export of grown plants, flowers and fruits has to be developed by long term planning. Government organisations have

a major role to play mainly coordinating among horticulture, tissue culture labs and farmers and marketing, so that all aspects of commercialisation develop equally and simultaneously to get maximum benefits. At the moment there is big communication gap among different branches which are interdependent. However, organizing cells which can supply all round information at reasonable prices should communicate with different branches so that this gap can be bridged effectively.

Further government has to coordinate work of several tissue culture labs all over the country to come up with very thorough protocols for different useful plants. Though several hundreds of papers are published every year, practical application of protocols fail usually due to lack of professional approach. Government should monitor tissue culture activities and handle transfer of technology by a single lobby. Patenting of protocols and new varieties may accelerate the transfer of technology and improvement of techniques faster than any other incentives to scientists/organisations involved, thus saving precious foreign exchange in importing costly technologies from developed countries.

One major necessity with all the small micropropagation labs coming into existence will be the very efficient pathogen indexing, testing and eliminating. Without these the units will be at disadvantage against big labs who can afford their own testing laboratories and can compete in international markets in far easier way. So initially several government labs should specialize such a work and help private organisation in a professional way*.

Suggested books for further reading :

1. Handbook of Plant Cell Culture, Macmillan Company, 1986.
2. Micropropagation Technology and Application, P. C. Debergh and R. H. Zimmerman Eds., Academic Publishing, 1991.
3. Tissue Culture Technologies for Horticultural Crops, K Torres, Van Nostrand Reinhold, New York 1988

II

A MARKET STUDY

INTERNAL MARKET

Internal market study was conducted mainly in and around Delhi. Internal market for tissue culture derived plants in cardamom and banana and some horticultural plants exists in Kerala state. For horticultural plants, market exists in Bangalore and Nasik, for bananas in Gujarat near Ahmedabad and in Maharastra.

Delhi has about 100 small and big nurseries, who sell about 20 major varieties of flower and foliage plants. For list of plants see Table 9. There are about 900 acres of rose, tube rose and gladioli farms, who supply foliage and cutflowers for Delhi market. There are about four wholesalers in exotic flower trade, about seventy florishops and two hundred and fifty pavement sellers and hawkers of exotic cut flowers.

The flower market in Delhi is basically of two kinds - one for Indian varieties like marigold, jasmine, roses and chrysanthemums catering to temples the common public at large. These flowers are supplied through four auction places in old Delhi. Though this market covers business worth several crores of rupees a year (Rs 10 crores) it is not amenable to tissue culture methods presently since no research done on them. Villages around Delhi, Nasik, Jaipur and Gujarat supply flowers at these auctions. Railway arrivals alone account for one wagon a day for 100 days and 5 to 10 tons per day for the rest of the days.

Exotic flower market is also huge in Delhi. It could be estimated as follows:

	Annual consumption (Rs)
10 large star hotels consuming more than Rs One lakh p.m. @1.5 lakhs each	1,80,00,000
50 other star hotels consuming @ Rs 15,000 per month	90,00,000
Daily sales by 5 wholesalers @ Rs 20,000 (excluding star hotels) per day, per wholesaler for 150 days	1,50,00,000
Other florist's sales in addition to whole salers	50,00,000
Sales of exotic plants in nurseries, 6 varieties at 2 lakh plants a year @ Rs. 5/-each	60,00,000
5 varieties at 1 lakh plants a year @ Rs. 10/- each	50,00,000
12 varieties at 50,000 each per year @ 20/- each	1,20,00,000
Other grown plants lumpsum	50,00,000
	7,50,00,000
Airport arrivals from Bangalore & Bombay etc. amount to 1500 Kg x Rs. 30 x 340 days	1,53,00,000
900 acres of farms producing @ Rs. 50,000 per year	4,50,00,000
Other arrivals through trucks, trains, etc.	1,50,00,000
	7,53,00,00
TOTAL approx.	**Rs. 7,50,00,00**

Table 2 List of plants sold by major nurseries in Delhi

S. No	Name of the plant	Sales exceeding lakhs of plants
1.	Dieffenbachia	3 lakhs and above
2.	Dracaena	”
3.	Aglonema	”
4.	Ficus	”
5.	Philodendron	”
6.	Codiaeum	”
7.	Begonia	2 lakh
8.	Monstera	”
9.	Cordyline	”
10.	Syngonium	”
11.	Peporomia	”
12.	Money plant	0.50 lakh
13.	Asparagaus	”
14.	Spathiphyllum	”
15.	Araucaria	”
16.	Palms	”
17.	Caladium	”
18.	Fern	”
19.	Acalypha	”
20.	Mussaenda	”
21.	Scindapsus	”
22.	Cissus	”
23.	Schefflera	”

EXTERNAL :

U.S.A, EEC, Canada and Japan are known rich markets in the world. The world floritrade is of the order of above ten thousand crores of rupees per annum, Switzerland Austria, Sweden, Norway and Singapore are also rich markets.

One estimate provided by a promotional agency, CBI, Netherlands, is that European market for cut flowers and flower posts in 1990 alone is of the value of 39 billion guilders.

Pot plants	16 b guilders x 13	=	20800 (Rs.in crores)
Cut flowers	23 b guilders x 13	=	29900 (Rs.in crores)
Total	**39 b guilders x 13**	=	**50700 (Rs. in crores)**

The Netherlands is the leader in the world flower trade with 68% of total world exports of cut flowers and 51% of total world exports of pot plants in its hold. This shows how vast world floritrade is. It is of the order of Rs. 10,000 crores.

Table 3 Its imports volume in the Netherlands was as follows:

Year	Quantity in Kgs	Value in Dfl.m	Value in Crores @ Rs. 13 per Dfl.
1987	82,922	451.9	587.5
1988	91,803	508.6	661.1
1989	1,01,119	560.0	728.0

Detailed statements showing the volume of floritrade in various countries during the previous decade are furnished in Tables 6 to 8.

— Important conclusion that could be drawn from the tables are as follows:

— World floritrade has been continuously increasing from 1981 to 1989.

— Exports have increased from Rs. 6594.6 crores to an order of Rs. 10,000 crores.

— In the Netherlands which is the leader of this sphere, imports increased from 452 m.guilders to 560m guilders and 82,922 to 1,01,119 tons during 1987-1989.

— Except orchids and foliage plants which showed slight decrease, all other product fronts were either stable or showed an upward trend in The Netherlands and Europe.

— Similarly the exports from The Netherlands increased from 4008 million guilders to 4815 million guilders and the quantity rose from 4.52 lakh tons to 5.67 lakh tons. The volume of cutflowers in trade is twice that of pot plants.

— The average price of cut flowers has been decreasing. It fell from 0.54 to 0.50 Dfl. (Rs. 7.02 to Rs. 6.50) per stem on average.

— The role of developing countries is very limited. Orchid inputs into Europe originate almost entirely in developing countries. Roses, gladioli, chrysanthemums, other cutflowers, fresh foliage, rooted cuttings, rootless cuttings are also some varieties which developing countries manage to export. The importance of carnations, roses, chrysanthemums and rooted cuttings are increasing. Their importance is decreasing with respect to orchids, gladioli and flowering pot plants.

Table 7 furnishes the performance of developing countries in the share of European imports. Two important features of flower trade which are of great relvance to us in this country are :

a) The import prospect for cut flowers is mainly in winter ie. from November to March. 65% of Dutch non European imports are delivered during these months.

b) 70% of Dutch imports in cut flowers were for re-export, average price of export was 163%, 157% and 153%in '87,''88 and 89' respectively over import price.

The following table gives the average prices of imports and exports at The Netherlands markets and need pioneering over.

Table 4 The average import and export prices in the years 1987,1988 and 1989 in Netherlands

Average prices in Dfl	Imports			Exports		
	1987	1988	1989	1987	1988	1989
Fresh cut flowers	7.53	7.16	6.74	11.32	11.07	10.94
Roses	13.37	11.98	10.02	13.13	12.83	12.66
Carnations	6.25	6.07	5.58	10.70	10.66	9.99
Orchids	11.66	9.49	10.26	47.48	54.15	51.23
Gladioli	4.75	5.27	4.07	4.16	5.88	5.07
Chrysanthemums	5.48	6.07	5.88	9.87	10.44	8.69
Other cut flowers	8.05	7.67	7.47	11.00	10.40	10.97
Dried flowers	10.55	11.16	11.94	22.85	21.70	22.73
Foliage	6.22	6.16	7.03	8.82	6.37	6.39
Other live plants	3.74	3.99	4.02	5.97	5.82	5.61
Rooted cuttings	5.40	5.73	6.12	11.80	10.58	8.37
Rootless cuttings	3.29	3.49	3.71	10.51	12.86	11.07
Flowering pot plants	2.42	3.37	3.03	5.26	4.74	4.75
Foliage pot plants	3.81	3.62	3.36	5.86	5.69	5.46
Average	5.45	5.54	5.54	8.87	8.70	8.49

Source : CBS

A suitable strategy, evolved and executed on an appropriate scale should result in huge foreign earnings. The present Indian export status in floritrade is given in the statements in Table 8.

India's share in the market is less than 0.1%. The total exports on all categories is 2277.6 tons valued at Rs. 8.65 crores in 1990-91.

One could enter this export market as one of the small producers (who are about 1200 in number with less than 0.1m Dfl p.a.) by joining as a member of the auction or through an importer. European countries import bulk of their requirements from Netherlands and other neighbours. A small fraction (less than 10%) of these countries would also like to encourage direct imports from other countries. This could also be tapped. The market for flowers is expected to grow at 3.5% p.a While one could export quality cut flowers, the thrust should be to export tissue culture derived plants with or without acclimatisation (hardening).

The main customers for tissue culture derived plants are the farmers of horticultural lands concentrated around 12 auction places in Netherlands and other countries. Their strength has been vastly increasing.

Year	No. of Farmers	Area in Hectares
1970	7087	2519
1984	7617	4966
1989	11204	7083

Other European countries have also shown an increase in floriculture. For example, Norway's cultivation figures are as follows:

Table 5 Production area of cut flowers in Norway :

Year	Area in hectares for flower farming
1983	400.63
1985	404.50
1986	401.90
1987	378.80
1988	1656.30

(increase due to leap in Iris cultivation)

Source: Norimpad.

In other countries the exact number of farmers and the extent area not known. However, there are plant breeders in every country who farm in horticultural plants and compete in raising of quality products for the horticulture market. Their products are exhibited in various exhibitions. The prize winners and the farmers cultivating these cultivars would be anxious to make money in a short period before other fresh competitors arrive on the scene. Such farmers and plant breeders would both be the prospective customers and patient efforts have to be made to identify them and negotiate with them. Personal contacts abroad and patient knocking at various doorsteps would certainly yield a few customers who can keep the unit fully engaged. While the number of farmers (11,000 in Netherlands alone) and farms (7000 hectares in Netherlands alone) are numerous and the tissue culture labs all over the world over which could serve their purpose are a little more than 300 with an estimated capacity of 350 million plants p.a. (can serve 3000 hectares of farming) Another estimate by RLM Pierick states that in Western Europe, the total capacity of plants is 212.5 million p.a. in about 248 labs to serve the needs of not only the horticulturists but also producers of vegetables, forest trees and other commercial and food crops as well. The deficit is enormous. Hencethere is great scope and need for tissue culture labs, more so, in our country where the costs of production of tissue culture derived plants would be far cheaper and hence exportable.

Prices and Market costs:

The prices of cut flowers and the pot plants abroad for major varieties and the market costs over and above the FOB costs are conducive to profitable production here.

Import prices of major cutflower types and pot plants.

	1987	1988	1989
Average for major varieties of Cut flowers Rs/kg	97.89	93.08	87.62
Other live plants each	48.62	51.87	52.26

[report of Agri. Economics Research Institute, Hague]

From the above, which may be taken to represent the importers CIF price, the exlab value available to exporter may be obtained as follows:

Import value per kg for cut flowers		Rs. 87.62
less 40% transport etc. over & above FOB price	$\frac{87.62 \times 60}{100}$	
		Rs. 52.57
Less local transport packing @ 10%	$\frac{52.57 \times 90}{100}$	Rs. 47.31
least price available for exporter for a kg of cutflowers as a whole (exfactory price is)		Rs. 47.31

For Carnations:

CIF cut flower per kg (least price in 3 years 87,88,89) IBID	Dfl 5.58 x 13	Rs. 72.54
Less 40% transport etc. above FOB including duties etc.	$\frac{72.54 \times 60}{100}$	Rs. 43.52
Less package transport@ 10%	$\frac{43.52 \times 90}{100}$	Rs. 39.17
Least price available ex-lab } for a kg of carnation flower stems}		Rs. 39.17

For an Orchid variety Christina Nr. the net opportunity cost ex-lab on the basis of March 91 price can similarly be derived as follows:

Price per stem of orchid flower of import into The Netherlands March 1991:

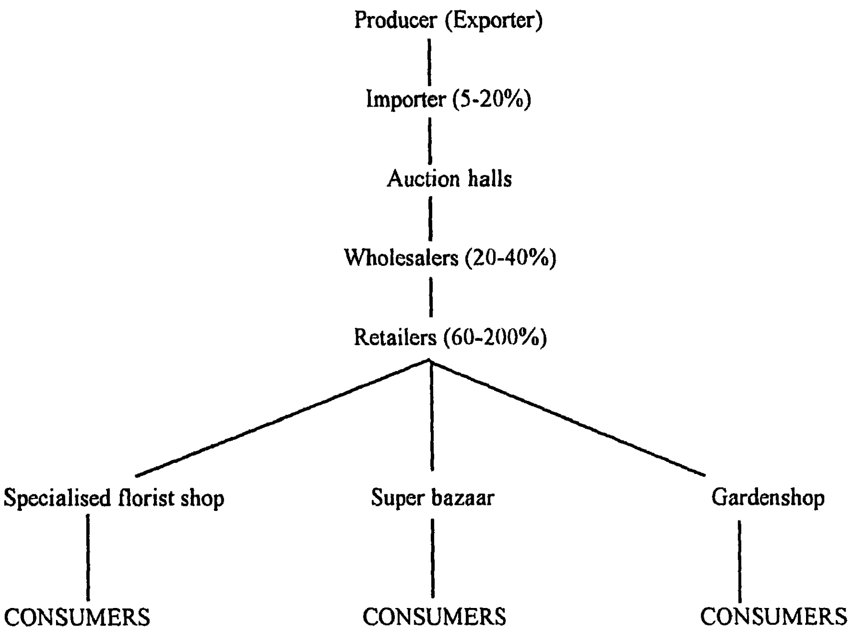
(UN Bulletin)	Max per stem	$ 0.51
	Min per stem	$ 0.41
Wholesale minimum per stem price during March 1991	0.41 x 25.55	Rs. 10.46
Less wholesalers trade margin 12%	$\frac{10.46 \times 88}{100}$	Rs. 9.21
Importer's trade margin @ 6%	$\frac{9.21 \times 94}{100}$	Rs. 8.66
Less transport charges, duties 13%		Rs. 7.53
Less packaging present (standard) and internal transport 10%	$\frac{7.53 \times 90}{100}$	Rs. 6.78
Price available for an orchid flower stem exlab		Rs. 6.78
Further assuming 5 flower stems per plant		
Cost per flowering plant in the variety	6.78 x 5	Rs. 33.90
Less Cost of intensified farming per (excluding seed) plant	6.00	Rs. 27.90
Opportunity share of tissue culture derived plant	Rs. 27.90 or Rs. 25 approx.	

The exporter's price from Netherlands is almost 2.5 to 3 times the import price i.e., if Netherland's re-export price is taken into consideration, the opportunity available for the exporter to Netherlands is far higher depending on the demand.

This is in consonance with the facts in Switzerland & The Netherlands, where the seedlings cost 0.07 to 1.0 Swiss Frank with around 20% to 25% preference for tissue culture derived seedlings.

One should limit their price to Rs. 15/- per plant or even less and the balance of Rs. 10/- per plant or more would be spent on packing merchandising and advertising during initial years. A decline in this price is also envisaged in future, though volume will certainly grow. A portion of the amount may be utilized to sustain 25% sale at local nurseries or horticultural farms at Rs. 7/- or 8/- per plant(the rate available for banana being Rs. 6/- by others in the field). While traditionally banana seedling is free or even has negative cost, the normal ornamental plantlets are even now purchased at a cost up to Rs. 4/-.

Possible distribution channels abroad for cut flowers & foliage plants



Possible Distribution Channels (Local and Abroad) for Seedlings

Supplies are based mostly on personal acquaintance basically from farmer to farmer. Payment is based on survival of the seedlings at site.

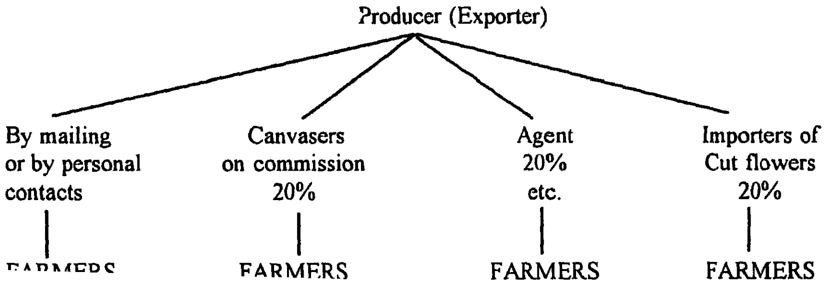


Table 6 The imports, exports and prices of floriculture products into, from and within the European Community.

Volume in 1000Kg; Value in million Dfl; Price in Dfl

	Imports 1989			Exports 1989		
	Volume	Value	Price	Volume	Value	Price
Fresh cut flowers	354176	3420.2	9.66	341195	3681.3	10.79
Roses	47115	514.0	10.91	46386	592.1	2.76
Carnations	75252	618.1	8.21	54392	436.8	8.03
Orchids	6072	115.7	19.05	3716	110.0	29.60
Gladioli	4444	20.2	5.55	6426	32.2	5.01
Chrysanthemums	38559	340.5	8.83	47835	413.1	8.64
Other cut flowers	182734	1811.7	9.91	182440	2097.2	11.50
Dried cut flowers	7343	124.2	16.91	6727	133.5	19.85
Fresh foliage	30612	228.2	7.45	5905	41.2	6.98
Dried foliage	7431	42.6	5.73	2351	23.5	10.00
Painted foliage	5335	47.7	8.94	6965	60.1	8.63
Other live plants	420394	2166.2	5.15	451337	4435.4	9.38
Rooted cuttings	33502	208.8	6.23	25983	217.4	8.37
Rootless cuttings	22451	131.4	5.85	7687	66.4	8.64
Flowering pot plants	76126	398.0	5.23	109777	590.8	5.38
Foliage plants	288315	1428.0	4.95	307890	1604.2	5.21
Total	**812525**	**5938.8**	**7.31**	**805164**	**8291.4**	**10.30**

Source CBI

Table 7 A detailed review of the imports into the European Community in 1988 and 1989 per product group and developing countries.

Value in million Dfl	1988	1989
Fresh cut flowers		
Total	**3192.5**	**3420.1**
EC	2690.8	2901.4
Other industrial countries	257.7	247.7
Developing countries total	244.0	271.0
Colombia	83.8	89.5
Kenya	57.2	64.4
Thailand	41.8	47.4
Morocco	12.2	15.5
Zimbabwe	12.6	15.2
Ethiopia	5.6	6.4
Peru	4.8	5.0
Ecuador	4.2	4.5

Value in million.Dfl	1988	1989
Mauritius	3.8	4.2
Brazil	3.2	3.4
Singapore	3.1	3.2
Ivorycost	2.2	1.8
Swaziland	2.0	1.5
Martinique	1.2	1.8
Zambia	0.9	1.9
Chili	0.9	0.9
Costa Rica	0.5	0.5
Rwanda	0.4	0.6
Guadeloupe	0.4	0.4
Jamaica	0.4	0.1
Tunisia	0.2	0.3
Tanzania	0.2	0.3
Cameroon	0.1	0.4
Argentina	0.2	0.2
Venezuela	0.2	0.2
Burundi	0.1	0.1
Dom.Republic	0.0	0.2
Malaysia	0.1	0.1
Honduras	-	0.1
Malawi	-	0.1
Roses		
Total	**491.0**	**514.0**
EC	395.8	416.6
Other industrial countries	66.0	66.2
Developing countries total	29.2	31.2
Morocco	11.2	13.7
Colombia	7.9	6.2
Ecuador	3.9	3.0
Brazil	1.9	2.6
Kenya	1.8	2.4
Zimbabwe	1.1	2.0
Mexico	1.4	1.2
Carnations		
Total	**604.5**	**618.0**
EC	434.6	443.0
Other industrial countries	63.1	56.8
Developing countries total	106.8	118.2
Colombia	73.8	80.3
Kenya	31.0	34.1
Morocco	0.4	1.4
Chile	0.9	0.9
Peru	0.2	0.5
Ecuador	0.1	0.4
Rwanda	0.4	0.4
Cameroon	0.0	0.2

Contd.......

Value in million Dfl	1988	1989
Orchids		
Total	**115.3**	**115.8**
EC	67.5	62.8
Other industrial countries	2.5	2.2
Developing countries total	45.3	50.8
Thailand	41.6	47.2
Singapore	3.1	3.1
Brazil	0.5	0.3
Colombia	0.1	0.1
Gladioli		
Total	**23.1**	**20.2**
EC	20.0	18.6
Other industrial countries	1.4	0.4
Developing countries total	1.7	1.1
Zambia	0.5	0.5
Brazil	0.6	0.4
Zimbabwe	0.3	0.1
Tunisia	0.0	0.1
Morocco	0.3	0.0
Chrysanthemums		
Total	**326.7**	**340.5**
EC	305.6	319.6
Otherindustrial countries	19.5	19.4
Developing countries total	1.6	1.5
Zimbabwe	1.4	1.9
Colombia	0.2	0.6
Other cut flowers		
Total	1632.0	1811.6
EC	1467.2	1641.0
Other industrial countries	106.3	105.6
Developing countries total	58.5	65.0
Kenya	24.3	27.9
Zimbabwe	9.8	11.1
Ethiopoia	5.6	6.4
Peru	4.5	4.5
Mauritius	3.8	4.2
Colombia	1.9	2.0
Ivory Coast	2.2	1.8
Swaziland	1.8	1.4
Martinique	1.2	1.8
Equador	0.2	1.1
Costa Rica	0.4	0.4
Guadeloupe	0.4	0.4
Morocco	0.4	0.4
Mexico	0.2	0.4
Zambia	0.4	0.3
Tanzania	0.2	0.3

Value in million Dfl	1988	1989
Zamaica	0.4	0.1
Argentina	0.2	0.1
Tunisia	0.2	0.1
Dried cut flowers		
Total	**105.5**	**124.2**
EC	90.9	108.6
Other industrial countries	12.3	12.6
Developing countries total	2.3	3.0
Tunisia	0.8	1.2
Brazil	1.2	0.9
India	0.2	0.3
Thailand	0.0	0.3
Taiwan	0.1	0.2
Fresh foliage		
Total	**190.2**	**228.2**
EC	55.4	60.3
Other industrial countries	93.0	120.9
Developing countries total	41.8	47.0
Costa Rica	30.6	34.4
Guatemala	4.9	5.2
Mexico	1.5	2.0
Panama	0.8	1.1
Sri Lanka	0.6	1.1
Honduras	0.7	0.9
Uruguay	0.3	0.9
Indonesia	0.3	0.6
Swaziland	1.3	0.3
Ivory Coast	0.3	0.3
Kenya	0.2	0.3
Chile	0.1	0.3
Guadeloupe	0.1	0.2
Colombia	0.0	0.2
Brazil	0.0	0.1
Ecuador	0.0	0.1
Argentina	0.1	0.0
Foliage without flowers and dried		
Total	**38.6**	**42.6**
EC	17.7	16.1
Other industrial countries	15.0	18.5
Developing countries total	5.9	8.0
India	3.7	4.4
Brazil	1.4	2.3
Haiti	0.2	0.3
Mexico	0.1	0.2
Philippines	0.1	0.2
Guatemala	0.0	0.2
Costa Rica	0.2	0.0

Value in million Dfl	1988	1989
Kenya	0.1	0.1
Chile	0.1	0.1
South Korea	0.0	0.1
Indonesia	0.0	0.1
Thailand	0.0	0.1
Foliage without flowers painted		
Total	**37.2**	**47.7**
EC	28.0	35.1
Other industrial countries	8.2	11.2
Developing countries total	1.0	1.4
India	0.5	0.8
Taiwan	0.2	0.5
Philippines	0.1	0.1
Thailand	0.1	0.0
Brazil	0.1	0.0
Rooted cuttings		
Total	**162.3**	**208.8**
EC	116.8	154.2
Other industrial countries	10.3	12.4
Developing countries total	35.2	42.2
Costa Rica	15.8	23.0
Ivory Coast	3.8	3.4
Sri Lanka	3.4	3.3
Guatimala	1.8	2.6
Honduras	2.1	2.5
Brazil	1.7	1.5
Taiwan	1.4	1.4
Singapore	1.0	1.3
St.Lucia	1.3	0.7
Thailand	0.3	0.5
Malaysia	0.4	0.4
Togo	0.4	0.4
India	0.2	0.4
Rwanda	0.4	0.3
Dom.Republic	0.3	0.2
South Korea	0.4	0.1
Kenya	0.3	0.1
Barbados	0.2	0.1
Rootless cuttings		
Total	**123.3**	**131.4**
EC	41.1	40.1
Other industrial countries	41.2	42.3
Developing countries total	41.0	49.0
Guatemala	12.7	15.4
Costa Rica	8.9	11.4
Kenya	5.0	5.1
Honduras	3.5	4.3

Value in million Dfl	1988	1989
Rwanda	2.7	2.5
Brazil	1.8	3.1
El Salvador	1.5	1.5
Mexico	1.1	1.3
Sri Lanka	0.8	1.1
Ivory Coast	0.9	0.9
Togo	1.1	0.8
Burundi	0.5	0.7
Morocco	0.3	0.5
Singapore	0.2	0.3
Flowering pot plants		
Total	**390.8**	**398.0**
EC	389.3	396.9
Other industrial countries	1.2	0.8
Developing countries total	0.3	0.3
Taiwan	0.1	0.2
South Korea	0.0	0.1
Costa Rica	0.1	0.0
Guatemala	0.1	0.0
Foliage pot plants		
Total	**1270.0**	**1428.0**
EC	1203.5	1366.0
Other industrial countries	34.3	32.2
Developing countries total	32.2	29.8
Singapore	5.9	7.0
Guatemala	5.3	4.3
Costa Rica	5.6	3.5
Taiwan	2.7	3.0
Ivory Coast	3.3	2.7
Sri.Lanka	2.2	2.2
Dom.Republic	1.7	1.9
South Korea	0.4	1.3
Brazil	1.4	0.9
Thailand	0.8	0.8
Honduras	1.5	0.6
Burundi	0.1	0.3
Indonesia	0.3	0.3
Reunion	0.2	0.3
Morocco	0.1	0.2
St.Lucia	0.1	0.1
Kenya	0.2	0.0
Philippines	0.1	0.1
Togo	0.1	0.1
Mexico	0.1	0.1

Table 8 Statement Showing Indian Exports - 1990-1991

Country Name	Quantity (In Kgs)	Value (In Rs.)
Fresh Cut Flowers		
Australia	1300.00	82826.00
Bahrain	665.00	4109.00
W. Germany	8365.00	382789.00
U.K.	13670.00	417559.00
Italy	2166.00	108323.00
Kuwait	1440.00	83495.00
Maldiwes	9.00	1087.00
Oman	10.00	872.00
Saudi Arabia	835.00	4312.00
Dubai	10588.00	240741.25
U.S.A.	3000.00	194842.00
**** Subtotal****	**42048.00**	**1520955.25**
Flower Seeds		
W. Germany	5.00	18532.00
Italy	280.00	761000.00
Japan	53000.00	1057000.00
Kenya	1000.00	23000.00
Netherland	2794.00	1051736.00
U.S.A.	1982.20	126261.00
****Subtotal****	**59161.20**	**3037529.00**
Other Floricultural Products		
	6000.00	18000.00
Spain	7.30	3990.00
W. Germany	37164.00	1344515.00
England	15104.00	672174.00
Italy	11385.00	152441.00
Japan	2500.00	66247.00
Maldives	6.00	730.00
Malaysia	0.00	62375.00
Holland	14585.00	750884.00
Muscat	1151.00	161626.00
Sweden	75.00	23396.00
Taiwan	1180.00	72891.00
U.A.E.	1047.00	117861.00
New York	127170.00	2577229.00
****Subtotal****	**217374.30**	**6024359.00**

Country Name	Quantity (In Kgs)	Value (In Rs.)
Plants Dried		
England	10034.00	389672.00
Japan	2300.00	140812.00
Kuwait	00.00	5000.00
Malaysia	19100.00	437000.00
U.S.A.	25947.00	777329.00
****Subtotal****	**57381.00**	**1749813.00**
Flowers Dried		
Austria	7460.00	994358.00
Canada	6354.00	245524.00
Spain	24339.00	1245138.00
Antwerp	9452.00	2010319.00
West Germany	364637.00	12260682.00
Felixstowe	337692.00	13298432.00
Hong Kong	3882.00	241979.00
Holland	0.00	402000.00
Italy	46571.00	5736538.00
Japan	19877.00	1171495.00
Korea	3208.00	167140.00
Holand	3208.00	167140.00
Saudi Arabia	32500.00	577989.00
Keelung	4497.00	380338.00
U.S.A.	465824.00	18365972.00
Yugoslavia	10.00	22187.00
**** Subtotal ****	**1387713.00**	**61950995.00**
Fresh Live Plants		
	0.00	159000.00
Bharain	2510.00	222274.00
U.K.	2264.00	111375.00
Japan	17000.00	45834.00
Kuwait	325000.00	7984008.00
Colombo	173.00	18136.00
Malaysia	0.00	2427.00
Holland	4244.00	200079.00
Muscat	258.00	88921.00
Qatar	1513.00	94717.00
Saudi Arabia	19500.00	284116.00
U.A.E.	140029.00	1806912.00
USA	1535.00	94396.00
****Sub Total****	**514026.00**	**11112195.00**
Grand Total of All Sub-Groups	**22277703.00**	**85395846.00**

III

PROJECT COST

CAPACITY

Keeping in view the margins that a technocrat can bear, the entrepreneurial capacity, the caution required of a new generation entrepreneur, the working capital bottle necks, the initial slow realizability of returns and the need to train technicians, the transport delays in keeping up schedule, a minimum viable unit is proposed. Initially two lakh tissue culture derived plants per annum is proposed which can be expanded shortly in about four years to one million plants p.a. In case foreign tie up/collaboration/foreign equity are available shortly, the capacity may be reached even earlier.

I Year	II Year	III ear	IV Year	V year
-	2.0 lakhs	5.0 lakhs	5.0 lakhs	10.0 lakhs

IMPORT COMPONENT :

Most of the material going into the process is indigenous. A few items like hormones and vitamins may have to be imported if the quality of is not very well maintained by the local companies. However, the volume of their consumption is very little as they are used in milligram quantities. Clone material may have to be imported, particularly if it is a matter of job work undertaken for a foreigner. However, no import is envisaged for the first two or three years unless it is for job work. Material in the country can be made use of in the beginning.

FINANCIAL OUTLAY FOR FIRST TWO YEARS

Financial analysis is given in the following pages giving year-wise growth to full capacity and the initial incubation period.

Though the thrust is on production of plantlets through tissue culture, a nursery is proposed to be maintained attached to the unit. This would serve as a demonstration plot. During first two years when tissue culture derived plants are not yet in sufficient stock, one could maintain the nursery (even form the beginning) with exotic plants purchased from Bangalore, Kalimpong or botanical gardens and from other labs. The receipts from nurseries may help initially by providing receipts to working capital needs. One could also gain experience with the local weather. During the third year, an acre of land is needed within a few kms of lab and a part of the greenhouse nursery should be started there. The ultimate aim would be to develop the lab and clone material in the entire original site, shifting the entire greenhouse into the farm land (partly for greenhouse farming and partly for open farming) in due course. After the unit start producing tissue culture plants, the value added at nursery level after hardening is recovered and no profit is charged. Profit is charged only on tissue culture derived plants. In the financial analysis is the following pages nuesery activity is shown only during first two years, and ceases to be of any direct monetary significance after that.

The incubation period for the unit is 4 months for construction and 16 months for raising mother material to a level from which 50,000 plants can be produced every 2 months, the calculations are shown for the first two years combined.

Fixed Capital : 8,20,800

Particulars	Amount (Rs.)
Cost of land	2,26,000
Building 130 sq. mts carpet area @ Rs. 2100 sq. mts to suit lab requirement	2,75,200
Electricity supply, internal wiring	10,000
Tube well lumpsum 30 mts deep 100 mm pipe delivery	75,000
Compound wall	58,100
Green house 182 sq. mts. dimension depending on plot measurements and a net house 400 sq. mts	1,76,700
Total	8,20,800

Equipment : 10,29,000 41,41,000

Particulars	Ist year Rs.	Vth year Rs.
Air conditioning	1,12,500	4,85,000
Culture racks	36,960	2,05,000
Culture bottles	13,450	1,50,000
Laminar flow hoods	50,000	1,70,000
Bottle washing equipment	3,300	25,000
Autoclaves	26,500	2,00,000
Vehicle	1,52,000	3,00,000
Refrigerator	7,000	34,000
Balance	20,000	20,000
Trays for culture bottles	5,000	25,000
pH meter	10,000	10,000
Generator	1,10,000	2,00,000
Computer	80,000	80,000
Electric oven	8,500	50,000
Water distillation unit	10,500	50,000
Temperature controllers	8,970	20,000
Timers	8,850	40,000
Protrays	5,000	50,000

Equipment :

Particulars	Ist year Amount (Rs.)	Vth year Amount (Rs.)
Clone material	1,59,000	8,00,000
Room heaters	3,000	20,000
Stabilizers	13,00	20,000
Stirrers	2,600	6,000
Bunsen burners	1,000	4,000
Forceps, Scalpels etc,	4,000	20,000
Exhaust fans	62,000	1,20,000
Cooling pads	10,000	50,000
Humidcare	10,300	10,300
Gas cylinder	4,000	4,000
Pots for nursery	40,000	40,000
Test tubes	3,600	3,600
ELISA equipment	-	7,00,000
Add. greenhouse equipment	-	50,000
Incubators	-	20,000
Misc. equipment	10,850	70,000
Taxes, octroi, installation etc.	53,120	1,29,100
Total	**10,45,000**	**41,41,000**

Working Capital : 2,83,200

Particulars		Amount (Rs.)
Tissue culture lab		
Wages for 2 skilled technicians@ Rs. 1,000 p.m. each		2,000
One lab assistant	@ Rs. 1200/- p.m.	1,200
Two (Mali) Gardeners	@ Rs. 1000/- p.m.	2000
Thrre unskilled worker	@ Rs. 1000./- p.m.	3,000
One chowkidar	@ Rs. 1000/- p.m.	1,000
Total wages for tissue culture lab p.m.		9,200
Power, electricity & diesel oil		3,000
Phone & Telex		500
Chemicals		4,000

Particulars		Amount (Rs.)
Stationary and postage		500
Literature and journals		300
Misc expenses		200
Running expenses for tissue culture lab p.m.		8,500
Nursery		
Cost of 10,000 plants	@ Rs. 10/- each	1,00,000
Cost of manure, fertilizer, etc		27,000
Cost of pots	@ Rs. 5/- each	50,000
Total		1,77,000
Total working capital required: Six months expense for tissue culture lab @ 17,700/- p.m.		1,06,200
Nursery		1,77,000
Total		**2,83,200**

Total Capital **25,83,200**

Particulars	Amount (Rs.)
Fixed capital land & Buildings	8,21,000
Equipment	10,45,000
Working capital	2,83,200
Pre-operative expenses (including first year's interest)	4,34,000
Total	25,83,200

Returns at the end of second year : **34,01,000**

Particulars	Amount (Rs.)
Nursery returns @ 17,000/- for 13 months allowing five months for seasonal variations and six months incubation period initially @ 25/- per plant on an average	2,21,000
Tissue culture plant sales @ Rs. 8/- per plant for 2,00,000 plants and Rs. 4/- per plant for 2,00,000 in secondary nursery @ 70% and 80% respectively during Ist and 2nd years and 20% loses	31,73,500
Total	33,94,500

Production costs : **24,96,000**

Particulars	Amount (Rs.)
Pre-operative expenses	4,34,000
Working costs (2,83,200 x 4) for 2 years	11,32,800
Depreciation on building @ 10% for 2 year	1,24,000
Dep. on equipment @ 10% for 2 years	1,70,000
Interest for 2 years	5,36,000
Breakages, contamination, rejections and other risks	1,00,000
Total	24,96,000

Profit : **7,09,000**

Particulars	Amount (Rs.)
Sales	33,94,500
Costs	24,96,000
Net profit	**Rs. 8,98,500**

Rate of profit on total capital = 34.74%

BEP	**= 58.90%**

Fixed costs	Variable
11,92,00	5,00,000

Repayment:

Interest	5,36,000
Principal	2,08,000
Total	7,44,000

FINANCIAL OUTLAY FOR THIRD YEAR :

Financial analysis for 3rd year on expansion to 5 lakh plants by the end of third year and to create base for expansion to 10 lakhs by end of fourth year.

Fixed costs : 14,69,000 8,21,000 6,48,600

Particulars	Total (Rs.)	Already Invested (Rs.)	Addl. amount required (Rs.)
2000 sq. mt of land for lab & greenhouse	2,26,000	2,26,000	-
Farm land 1 acre	1,50,000	-	1,50,000
Buildings extra 124 sq. mts	5,35,400	2,75,000	2,60,400
Electricity wiring	20,000	10,000	10,000
Tube well	75,000	75,000	-
Greenhouse 245 sq mts.	3,88,000	1,76,000	2,11,300
Compound wall (height to be raised)	75,000	58,100	16,900
Total	**14,69,000**	**8,21,000**	**6,48,600**

Machinery : 27,41,000 10,29,000 17,12,000

Equipment	22,41,000	8,70,000	13,71,000
Clone material	5,00,000	1,59,000	3,41,000
Total	**27,41,000**	**10,29,000**	**17,12,000**

Working capital per month : 26,400 9,200 17,200

Particulars	Rs.	Rs.	Rs.
6 Wages for technicians	9,000	2,000	7,000
2 Lab attendants @ 1200 p.m.	2,400	1,200	1,200
4 Gardeners @ 1000 p.m.	4,000	2,000	2,000
8 unskilled workers @ 1000	8,000	3,000	5,000
1 Chowkidar @ 1000 p.m.	1,000	1,000	-
1 Clerk cum accountant	1,000	-	1,000
1 Part time programmer	1,000	-	1,000
Total	**26,400**	**9,200**	**17,200**

Working expenses (p.m.) :	105,000	8,500	96,500
Particulars	Rs.	Rs.	Rs.
Consumable stores	40,000	3,000	37,000
Light, power & fuel	40,000	3,000	37,000
Repairs & Maintenance	10,000	1,000	9,000
Misc. factory expenses	15,000	1,500	13,500
Total	105,000	8,500	96,500

Working expenses for 4 months 3,65,600 2,82,000 83,600

Djscontinue nursery activity relating to plants obtained from other cities on expansion. Utilize entire greenhouse area for or cultured plants only. In case nursery is found indispensable one oculd treat it as a separate unit. Open house farming if any has to be met from own resources, the expenditure not being high.

Capital required on expansion in third year :

Particulars	Total	Sanctioned initially	Additional required in 3rd year
Preoperative expenses	4,34,000	4,34,000	-
Land & buildings	14,69,400	8,20,800	6,488,600
Equipment including clones	27,41,000	10,29,000	17,12,000
Working capital	3,65,600	2,82,000	83,600
Total (Rs.)	50,10,000	25,65,800	24,44,200

During 3rd year additional seed capital assistance of Rs. 2.5 lakhs may be obtained in addition to Rs. 2.5 lakhs available during 1st year.

Receipts at the end of third year

Particulars	Amount (Rs.)
Sales receipts : Tissue Culture plants 4,50,00 x Rs. 8 allowing rejections contaminations etc. at the product level & customer level @ 10%	36,00,000
Plants from secondary Nursery 1,50,000 x Rs. 4	6,00,000
Total sales receipts	**42,00,000**

Cost of Production : **22,51,440**

Particulars	Amount (Rs.)
Working costs @ 3,65000 x 3	10,95,000
Drawals for 2 persons @ 10,000 p.m.	1,20,000
Interest on capital	5,03,000
Depreciation on land and buildings	3,33,440
Depreciation on equipment (except the clones)	2,00,000
Total costs	**22,51,440**

Profit :

Sales	Rs. 42,00,000
Costs	Rs. 22,51,440
Net profit	**Rs. 19,48,560**

Rate of profit on total capital 38.9%

BEP	36.3%

Assuming that 30% of working costs are to be maintained irrespective of sales, the BEP may be worked out as follows:-

Fixed costs	Variable cost	
6,06,000	8,22,000	
		= 36.3%
5,03,000	2,00,000	
11,09,000	11,42,000	

Repayment : **Rs.**

Principal	3,60,000
Interest	5,03,000
Total	**8,63,000**

FINANCIAL OUTLAY FOR FOURTH YEAR :

It is expected that full capacity of 1 million plants will be reached by the end of fourth year. While no major equipment is required to be purchased in addition, additional working capital would be required. A van for transport will also be needed and trolleys for internal transport would be required. This would be Rs. 3 lakhs say. Additional clones will have to be purchased or developed. Some of the clones may be imported or got through Indian national labs or private reputed labs. An amount of 3 lakhs is provided for the same.

Total capital during fourth year 60,44,400 50,10,000 10,34,400

Particulars	IV year	III year	Additional amount reqd.
Preoperative expenses	4,34,000	4,34,000	-
Land & Building	14,69,400	14,69,400	-
Equipment	33,41,000	27,41,000	6,00,000
Working capital	8,00,000	3,65,600	4,34,400
Total	**60,44,400**	**50,10,000**	**10,34,400**

Working capital requirements :

Work will be reorganised on 2 shift basis form 7 A.M. to 11 P.M.

Particulars	Per month	Rs.
4 Technicians	@ 1500/-	6,000
1 Lab attendants	@ 1200/-	1,200
4 Gardeners	@ 1000/-	4,000
4 Unskilled workers	@ 1000/-	4,000
1 clerk	@ 1000/- (on single shift basis)	1,000
1 Store keeper	@ 1000/- (do)	1,000
1 Part time programmer	@ 1000/- (do)	1,000
1 Transport supervisor (Packing & transport)	@ 1800/-	1,800
Consumable store:		
Power		25,000
Chemicals		26,000
Phone		1,000
Stationary & Postage		1,000
Transport		5,000
Packing & transport		20,000
Misc. including repairs		2,000
Total per shift		1,00,000
For two shifts		2,00,000

Since four months would be required forone cycle of operation before returns pour in, the amount of WC required is	8,00,000

Additional working capital limit required	8,00,000 (-)3,65,600	4,34,400

Returns at the end of fourth year

	(Rs.)
Assuming a lower rate @ Rs. 7/- per plant in view of competition, and assuming 5% rejections, the gross return is estimated at Rs. 9,50,000 x 7	71,25,000
Cost of Production :	**42,60,000**

Particulars	Rs.
Working costs	24,00,000
Depreciation	3,63,000
Interest on loans	5,44,000
Interest on own capital	3,33,000
Management drawals	1,20,000
Breakages & rejections	5,00,000
Total	**42,60,000**

Profit:

Sales	71,25,000
Costs	42,60,000
Net profit	**28,65,000**

Rate of profit on total capital:	47.4%
BEP :	**39.1%**

Fixed costs	Variable
9.34	14.66
3.63	3.33
5.44	5.00
18.41	24.19

= 39.1%

Repayment : **Rs.**

Interest on loan	5,44,000
Principal	6,82,000
Total	**12,26,000**

FINANCIAL OUTLAY FOR FIFTH YEAR :

During this year the full capacity achieved will be consolidated. For this purpose the lab will be strengthened with quality control equipment. Lab space will be extended by 500 sq. ft. and another greenhouse (20 x 15m) will be added.

Fixed Capital : **5,00,000**

Particulars	Amount (Rs.)
Additional buildings:	
Additional building (500 sq. ft.)	2,00,000
Additional greenhouse (15 x 20 mts)	3,00,000
Total	**5,00,000**

Additional equipment :

Particulars	Amount (Rs.)
ELISA quality control equipment	7,00,000
Addl. greenhosue equipment	50,000
Refrigerator	6,000
Two incubators	20,000
Misc. equipment, glassware etc.	20,000
Total	**7,96,000**

Working capital requirement per annum : **9,50,000**

Particulars		Amount (Rs.)
One farm supervisor	@ 2000 p.m.	2,000
One technician for ELISA	@ 1500 p.m.	1,500
One asst. for lab work	@ 1500 p.m.	1,500
One Jr. asst. Scientist	@ 3000 p.m.	3,000
6 unskilled workers	@ 1000 p.m.	6,000
Sub Total	**14,000 x 12**	**1,68,000**
Already invested in fourth year (2 shift basis)		4,80,000
Increment and other benefits to staff at @ 20%		96,000
Allowance increase in materials		2,06,000
Total		**9,50,000**

Additional working costs :

Ffth year	9,50,000
Fourth year	8,00,000
Total	1,50,000

Capital position at the beginning of Fifth year.

Particulars	V year	IV year	Additional investment required (Rs.)
Pre-operational expenses:	4,34,000	4,34,000	
Land & Buildings	19,69,400	14,69,400	5,00,000
Equipment	41,41,000	33,41,000	8,00,000
Working capital	9,50,000	8,00,000	1,50,000
Total	**74,94,400**	**60,44,400**	**14,50,000**

Returns at the end of Fifths year

Assuming a little higher rate than last year due to improved quality and improving in cut flower export the gross return expected is 9,50,000 x Rs. 8 **Rs. 76,00,000**

Cost of production: **43,38,000**

Particulars	Amount (Rs.)
Working costs	28,54,000
Interest on loans	6,23,000
Depreciation	5,11,000
Drawals	1,50,000
Rejections, contamination	2,00,000
Total	**43,38,000**

Profit **Rs. 32,62,000**

Particulars	Amount (Rs.)
Sales	76,00,000
Costs	43,38,000
Net profit	**32,62,000**

Rate of profit on total capital 43.0%

BEP :	**41.6%**

Fixed costs	Variable costs
16.68	11.86
2.00	5.11
1.50	6.23
20.18	23.20

Repayment: **17,47,160**

Interest	6,23,000
Principal	11,24,160
Total	**17, 47,160**

Summary (Project cost)

This project envisages a modest starting. Initially, a unit of 2 lakh plants per annum is envisaged with a capital of Rs. 25.32 lakhs. The construction and incubation period including, the capacity is attained only at the end of second year. The structures are so built, that with the experience gained, the unit jumps to 1.0 million plants by the end of fifth year.

The summary is as follows:

	Year				
	I	II	III	IV	V
Capacity in lakhs of tissue culture derived plants (nos lacs)	-	2.0	5.0	5.0	10.0
Investment additions:		**(Rs. in lacs)**			
Pre-operative expenses	2.77	2.77	4.34	4.34	4.34
Fixed capital	20.07	20.07	42.10	48.10	61.10
Working capital	2.48	2.82	0.32	4.68	0.50
Total	**25.32**	**25.66**	**50.10**	**60.44**	**74.94**

Table 9 Estimated Annual Requirements of Raw Materials

Raw material	1-Imported 2-Indigenous	Unit of Qty.	Quantity required: I year	 V year
Culture medium	2	litres	5,000	15,000
Micropots	2	numbers	2,00,000	10,00,000
Ethanol	2	litres	100	500
Hormones & Vita	1	grams	50	250
Manure	2	tons	1	5
Detergents	2	kg	100	500

PROJECTIONS OF PERFORMANCE, PROFITABILITY AND REPAYMENT

The profitability and cash flow is worked out with the assumptions given below:

1. Wage rate and prices of raw material increase at about 10% over previous year from 4th year.
2. Replacement of equipment is made in 6th year.
3. Maintenance and repairs costs to buildings are assumed at the following rates VI year - Rs. 5,00,000 and from VII year - Rs. 1,00,000 a year
4. Packaging, selling costs and administrative costs increase at about 10% over previous year from VI year.
5. Repairs to equipment is also shown under replacements @ Rs. 1,00,000 every year.
6. The formats that follow are prepared based on the project evaluation manuals of UN.

Table 10 Investment

Item	As the beginning of year (Rs. in lakhs)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Fixed assets												
1.1 Equipment	6.89	6.89	22.21	28.21	36.21	36.21	36.21	36.21	36.21	36.21	36.21	36.21
1.2 Installation & contingencies	1.61	1.61	included in the 1.1 above									
1. 3a Land	2.26	2.26	3.76	3.36	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76
1. 3b Buildings	5.95	5.95	10.93	10.93	15.93	15.93	15.93	15.93	15.93	15.93	15.93	15.93
1. 4a Others clones	1.59	1.59	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1. 4b Others misc.	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
2. Preliminary expenses												
2.1 Planing & Consultancy	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
2.2 Contingencies on preliminary expenses	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55
3. Working capital	2.48	2.82	3.66	8.00	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50
4. Initial investment (1+2+3)	23.75	24.09	48.53	58.87	73.37	73.37	73.37	73.37	73 37	73.37	73.37	73.37
5. Plus interest during construction	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57
6. Total investment	25.32	25.66	51.10	60.44	74.94	74.94	74.94	74.94	74.94	74.94	74.94	74.94
7. Net additional investment each year	25 32	0.34	24.44	10.34	14.50	-	-	-	-	-	-	-

Table 11. Depreciation Values

Item	Investment (lakhs)	Expected lifetime (years)	Rate (depreciation)	Year 1	2	3	4	5	6	7	8	9	10	11	12
1. Fixed assets															
1.1a Production equipment	7.38	10	10	0.85	0.85	2.24	2.24	3.62	4.08	4.08	4.08	4.76	5.06	4.59	4.59
1.1b Transport etc, contingencies	1.12	10	10	included in 1.1a above			–	–	–	–	–	–	–	–	–
1.2 Buildings	5.95	10	10	0.62	0.62	1.09	1.09	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59
1.3 Land	2.26	not depreciated		–	–	–	–	–	–	–	–	–	–	–	–
1.4a Other fixed assets	1.59	not depreciated		–	–	–	–	–	–	–	–	–	–	–	–
1.4b Others	0.20	*included in 1.2 above*		–	–	0.30	0.30 (transport Vehicle)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	–
2. Preliminary expenses	4.34	recovered in first year		4.34	–	–	–	–	–	–	–	–	–	–	–
3. Working capital	2.48*	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	25.32			1.47	5.81	3.33*	3.63*	5.11*	5.97	5.97	5.97	6.65	6.95	6.48	6.48

*Due to additional investments.

Table 12 Replacements

Item	Investment (lakhs)	Expected lifetime (years)	Rate of (depreciation)	REPLACEMENTS** Year 1	2	3	4	5	6	7	8	9	10	11	12	13
1. Fixed assets																
1.1a Production equipment	7.38	10	10	-	-	-	-	-	13.1	-	-	20.6	7.5	12.0	-	40.00
1.1b Transport etc, contingencies	1.12	10	10	-	-	-	-	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-
1.2 Buildings	5.95	10	10	-	-	-	-	-	5.0	1.0	1.0	1.0	1.0	1.0	1.0	-
1.3 Land	2.26	not depreciatd		-	-	-	-	-	-	-	-	-	-	-	-	3.76
1.4a Other fixed assets	1.59	not depreciated		-	-	-	-	-	-	-	-	-	-	-	-	10.00#
1.4b Others (transport vehicle)	0.20	included in 1.2		-	-	-	-	-	-	-	-	3.0	-	-	-	3.0
2. Preliminary expenses	4.34	recovered in Ist Yr.		-	-	-	-	-	-	-	-	-	-	-	-	-
3. Working capital	2.48*	-	-	-	-	-	-	-	-	-	-	-	-	-	- 9.50	##
Total	25.32	-	-	-	-	-	-	-	19.1	2.0	2.0	25.6	9.5	14.0	2.0	66.26

* Due to additional investments

** 50% price rise anticipated for replacements in equipment plus repairs costs of Rs. 1.0 lacs shown under equipment every year.

Table 13 Annual Manpower Requirements : Personnel

	No. of personnel														
	I year			II year			III year			IV year			V year		
Category of Manpower	S	U	T	S	U	T	S	U	T	S	U	T	S	U	T
1. **Manufacturing**	3	-	3	5	3	8	10	4	14	13	4	17	16	8	24
2. **Marketing**	-	-	-	-	-	-	1	2	3	2	2	4	2	4	6
3. **Supervisory**	-	-	-	-	-	-	1	2	3	1	3	4	2	3	5
4. **Administrative**	-	1	1	-	1	1	2	1	3	3	3	6	3	3	6
Grand total	3	1	4	5	4	9	14	9	23	19	12	31	23	18	41

Note: 1 No increase in staff envisaged further for this capacity

2. S. skilled. U unskilled. T : total

Table 14 Annual Manpower Requirements : Wages

	Average Annual Wages Rs. 1000														
	I year			II year			III year			IV year			V year		
Category of Manpower	S	U	T	S	U	T	S	U	T	S	U	T	S	U	T
1 Manufacturing	62.4	-	62.4	86.4	36.0	122.4	148.8	48.0	196.8	233.0	48.0	281.0	340.0	78.0	418.0
2. Marketing	-	-	-	-	-	-	18.0	24.0	42.0	37.0	24.0	61.0	44.0	53.0	97.0
3. Supervisory	-	-	-	-	-	-	18.0	24.0	42.0	18.0	36.0	54.0	57.0	43.0	100.0
4. Administrative	-	12.0	12.0	-	112.	12.0	24.0	12.0	36.0	48.0	36.0	84.0	58.0	43.0	101.0
Grand Total	62.4	12.0	74.4	86.4	48.0	134.4	208.8	108.0	316.8	336.0	144.0	480.0	499.0	217.0	716.0

Note · 1. Annual increase in wage bills is envisaged at 10% p.a.
2. S skilled; U : Unskilled; T: total

Table 15 Annaul Income (Rs. Lacs)

	1 year		2 year		3 year		4 year		5 year	6#	7	8	9	9	10	11	12
Item	Q	V	Q	V	Q	V	Q	V	Q	V	V	V	V	V	V	V	V
1. Annual sales	2.0	15.9	2.0	18.1	5.0	42.0	10.0	72.3	10.0	76.0	87.4	100.5	110.6	121.6	152.0*	152.0	152.0
Local	0.5	4.0	0.5	4.5	1.2	10.5	2.5	18.1	2.5	19.0	The ratio 1:3 is maintained through out between sales in the country and abroad						
Export	1.5	11.9	1.5	13.6	3.8	31.5	7.5	54.2	7.5	57.0	–	–	–	–	–	–	–
2. Subsidy	Not taken into account as the old incentive scheme has lapsed and rules on new incentive scheme are not yet available like genset subsidy are insignificant for the projections as a whole																
3. Residual values	Not worked on yearly basis but only at the end of the life of assets								–	–	–	–	–	–	–	–	–
Total income		15.9		18.1		42.0		72.3		76.0	87.4	100.5	110.6	121.6	152 0	152.0	152.0

1. * A leap is anticipated by three factors namely over reaching capacity, inflation and devaluation followed by lean period for next two years.
2. # Capacity during this period is stable at 10 lacs plants p.a. and hence only value is given
3. Q. - Quantity, (No of plants): V - Value, (Rs. in Lacs)

Table 16 Annual Operating Costs (Rs. in lacs)

	I Year			II Year			III Year			IV	V	VI	VII	VIII	IX	X	XI	XII
Item	V	F	T	V	F	T	V	F	T	T	F	T	T	T	T	T	T	T
1. Manufacturing expenses																		
1.1 Material	1.76	-	1.76	2.02	-	2.02	0.72	0.24	0.96	3.84	4.61	5.07	5.59	6.15	6.76	7.44	8.18	9.00
1.2 Wages	2.80	-	2.80*	3.08	-	3.08	1.00	0.97	1.97	2.81	4.18	4.60	5.06	5.56	6.12	6.73	7.40	8.14
1.3 Other mfg. exp.	1.08	0.24	1.32	1.26	0.24	1.50	1.60	0.78	2.38	6.00 1.20	7.00 1.20	9.02 8.00*	9.92	10.91	12.01	13.21	14.52	15.98
2. Marketing expenses																		
2.1 Material	-	-	-	-	-	-	3.60	0.60	4.20	7.20	7.40	9.21	10.12	11.14	12.26	13.48	14.83	16.31
2.2 Wages	-	-	-	-	-	-	0.42	-	0.42	0.61	0.97	--	--	--	--	--	--	--
3. Administrative expenses																		
3.1 Material	-	0.12	0.12	-	0.12	0.12	0.78	-	0.78	1.38	1.66	1.82	2.01	2.21	2.43	2.63	2.94	3.24
3.2 Wages	-	0.48	0.48	-	0.60	0.60	0.10	0.14	0.24	0.48	1.04	1.67	1.84	2.02	2.23	2.45	2.69	2.96
4. Operating expenses	5.64	0.84	6.48	6.36	0.96	7.32	8.22	2.73	10.95	23.52	28.06	39.39	34.54	37.99	41.81	45.94	50.56	55.63
5. Depreciation	-	1.47	1.47	-	1.47	1.47	-	3.3	3.33	3.63	5 11	5.97	5.97	5.97	6.65	6.95	6.48	6.48
Total costs (4+5)	5.64	2.31	7.95	6.36	2.43	8.79	8.22	6.06	14.28	27.14	33.17	45.36	40.51	43.96	48.46	52.89	57.04	62.11

1. Only total amounts are given from 4th year since the variable to fixed costs is neraly same through out till the 12th year
2. During the firts two yeras the unit may have to work with skeletons staff depending on casual workers mostlyl thereby limiting costs to about 11 lacs, i.e., to 67% shown above.
3. * major reparis to buildings etc.
4. V: variable cost; F : fixed cost; T:total

Table 17 Capital Structure (Rs. in lacs)

Item	YEAR											
	1	2	3	4	5	6	7	8	9	10	11	12
1. **Investment**	23.68	24.02	50.10	60.44	74.94	74.94	74.94	74.94	74.94	74.94	74.94	74.94
Interest during preop. period	1.64	1.64	-	-	-	-	-	-	-	-	-	-
2. **Financing**												
Equity	7.41	7.75	13.82	18.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
Seed capital	2.50	2.50	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Consultancy loan	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Term loan	13.56	13.56	29.43	30.43	38.93	38.93	38.93	38.93	38.93	38.93	38.93	38.93
Working capital	0.99	0.99	0.99	5.65	6.65	6.65	6.65	6.65	6.65	6.65	6.65	6.65
Total	25.32	25.66	50.10	60.44	74.94	74.94	74.94	74.94	74.94	74.94	74.94	74.94
3. **Net investment in the year**	25.32	0.34	24.44	10.34	14.50	-	-	-	-	-	-	-
4. **Net equity in the year**	7.41	-	6.07	4.68	5.00	-	-	-	-	-	-	-
5. **Net loans**	17.91	0.34	18.37	5.66	9.50	-	-	-	-	-	-	-

Table 18 Financial Obligations (Rs. in Lacs)

	Year											
Item	1	2	3	4	5	6	7	8	9	10	11	12
Term loan	-	1.11	2.74	2.74	2.74	2.74	2.24	-	-	-	-	
	-	-	-	2.12	2.12	22.12	2.12	2.12	2.12	2.15	-	-
	-	-	-	-	0.15	0.15	0.15	0.15	0.15	0.15	0.10	-
	-	-	-	-	-	1.21	1.21	1.21	1.21	1.21	1.21	1.24
BCIL Loan	0.16	0.22	0.21	0.11	-	-	-	-	-	-	-	
Seed capital	-	0.50	0.50	0.50	0.50	0.50	-	-	-	-	-	-
	-	-	-	-	0.50	0.50	0.50	0.50	0.50	-	-	-
Working Capital	-	0.09	0.15	0.15	0.15	0.15	0.15	0.15	0.15	-	-	-
	-	-	-	-	0.66	0.66	0.66	0.66	0.66	0.66	0.70	-
Total instalmennts	0.16	1.92	3.60	6.12	6.82	8.18	7.68	7.18	4.29	4.32	2.16	1.34
Interest on above loans	2.69	2.67	2.35	1.94	1.52	1.12	0.71	0.30	-	-	-	-
	-	-	-2.68	2.30	1.93	1.65	1.27	0.89	0.57	0.22	-	-
	-	-	-	1.20	1.05	0.90	0.75	0.60	0.45	0.30	0.15	0.15
	-	-	-	-	1.53	1.31	1.09	0.86	0.64	0.43	0.20	-
Total interest	2.69	2.67	5.03	5.44	6.03	4.98	3.82	2.65	1.66	0.95	0.35	0.15
Total	2.85	4.59	8.63	11.56	12.85	13.16	11.50	9,83	5.95	5.27	2.51	1.49

Table19 Integrated Financial Analysis Including Cash Flow (Rs. in Lacs)

Item	YEAR											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Investment	25.32	0.34	24.44	10.34	14.50	-	-	-	-	-	-	-
2. Operating cost	10.64	15.80	19.31	33.07	39.88	42.34	44.33	47.61	50.12	53.84	57.39	62.28
2.1 Cash expenses excluding interest	6.48	7.32	10.95	24.00	28.54	31.39	34.54	38.99	41.81	45.94	50.56	55.65
2.2 Depreciation	1.47	5.81	3.33	3.63	5.11	5.97	5.97	6.65	6.95	6.48	6.48	
2.3 Interest	2.69	2.67	5.03	5.44	6.23	4.98	3.82	2.65	1.66	0.95	0.35	0.15
3. Sales revenue	15.87	18.14	42.00	72.25	76.00	87.40	100.51	110.51	121.62	152.02	122.02	196.26
4. Net cash earnings												
4.1 Taxable profit (3-2)	5.23	2.34	22.69	39.18	236.12	45.06	56.18	62.95	67.37	98.36	64.63	133.98
4.2 Minus taxes @ 20% on profit	1.05	0.47	4.54	7.84	7.22	9.01	11.24	12.59	13.47	19.67	12.93	13.54
4.3 Net profit after taxes and interest	4.18	1.87	18.15	31.34	28.90	36.05	44.94	50.36	53.90	78.69	51.70	120.44
4.4 Plus interest	2.69	2.67	5.03	5.44	6.03	4.98	3.82	2.65	1.66	0.95	0.35	0.15
4.5 Net profit before interest & aftertaxes	6.87	4.54	23.18	36.78	34.93	41.03	48.76	53.01	54.56	79.64	52.05	120.59
4.6 Plus depreciation	1.4	5.81	3.33	3 63	5 11	5.97	5.97	5.97	6.65	6.95	6 48	6.48
4.7 Minus replacements	-	-	-	-	-	19.05	2.00	2.00	25.60	9.50	14.00	2.00
Total	8.34	9.35	26.51	40 41	40.04	27 95	52.73	56.98	36.61	77.09	44.53	125.07

Contd...

Table 19 Contd.................

Item	YEAR											
	1	2	3	4	5	6	7	8	9	10	11	12
5. Net cash flow	(-)16.98	9.01	2.07	30.07	25.54	27.95	52.73	56.98	36.61	77.09	44.53	125.07
6. Financial sources	25.32	0.34	24.44	10.34	14.50	-	-	-	-	-	-	-
6.1 Equity	7.41	-	6.07	4.68	5.00	-	-	-	-	-	-	-
6.2 Loans	17.91	0.34	18.37	5.66	9.50	-	-	-	-	-	-	-
7. Financial obligations	3.81	5.60	10.43	13.97	15.91	16.22	14.56	12.89	9.01	8.33	5.57	4.55
7.1 Repayment of instalment	0.16	1.92	3.60	6.12	6.82	8.18	7.68	7.18	4.29	4.32	2.16	1.34
7.2 Interest on loan	2.69	2.67	5.03	5.44	6.03	4.98	3.82	2.65	1.66	0.95	0.35	0.35
7.3 Interest on equity at 13%	0.96	1.01	1.80	2.41	3.06	3.06	3.06	3.06	3.06	3.06	3.06	3.06
8. Net cash balance	4.53	3.75	16.08	26.44	24.13	11.73	38.17	44.09	27.60	68.76	38.96	120.52
9. Cumulative net cash balance	4.53	8.28	24.36	50.80	74.93	86.66	124.83	168.92	196.52	265.28	304.24	424.76

APPENDIX - 1

Institutions and Categories of Individuals Contacted at Delhi (Typical but not exhaustive)

Export Promotion Zone, Noida.
Trade Development Authority.
Processed Food Export Promotion Council
SISI.
DIC.
Horticultural Section in Delhi Agricultural Department.
Air port : Domestic (Indian Airlines).
Air port : International (cargo section).
Airlines office : KLM airlines, Gulf Airways, Thai Airways..
Inspector of Factories, DDA.
DESU, Executive Engineer, Mehrauli, R. K. Puram.
Indo American Hybrid Seeds, R. K. Puram.
A dozen florist shops around Pallika Bazar, Connaught Place, Defence Colony, Shanti Niketan, Vasant Vihar etc.
Flower auction market, Old Delhi.
About 30 big nurseries and several small nurseries.
Farms : Sainik farms, Bijwasan, Chattarpur etc.
M/s. Verma Architects.
Industrial areas: Noida, Okhla, Secunderabad, Bhiwadi, Udyog Vihar, Gurgaon, Faridabad, etc.
Cut flower growing farmers in Chattarpur farms.
TERI.
IARI.
Delhi University.
Indian Institute of Foreign Trade.
Fabricators in Daruheda, Gurgaon etc.
Land Owners in Daruheda, Gurgaon etc.
US and British Libraries.
PHD House.
Several suppliers of tissue culture equipment in and around Delhi.

APPENDIX - II

INSTITUTIONS AND PERSON CONTACTED & VISITED ABROAD

Switzerland

1. W. Oertig AG. Altwiesenstrasse 27
8602, Wanger

2. Werner Lamprect, Horben 1
8303 Agusul (Illnou Effertikken)

3. Wiler, Ubernmittlung
Verbands

4. Wiler, Swiss Horticulture Asn.,
Verband Schweizerischer
Gartenermeister
Forech Strasse 287
8029 Zurich

5. Vonkaen Coop Schweiz
Prattel' n

6. UR sweiss, Topfplanzen kulturen
Salzweg, 50, 8048, Zurich

7. T. J. Joseph., Marketing Officer
Embassy of India
3008, Berne

8. Walder AG, Zurich
FAX 017100597

9. Samen Mauser Hauptsitz
Industriestress 24
8404 Winterthur

10. Dr. Thilar
In Vitro SWIGG AG
057341321, Kelleramstresse,
Geneva

11. W. Kohler, Lanzennuenforn
Faraunsefield
P Mayer 1602, Wangen

12. Horis berger
Aoche FAX : 0255261531

13. Seiler
M/s. Geissler AG
Gold Brunnen Strasse
157, Postfach, Zurich

14. FaRerh, Nurseries
Land Quart
(Chur)

15. Gunderod
Specialist in Marketing of
Floriproducts
ITC Gevena

16. Mrs. Darbre, Swiss Office of
Promotion of Trade
Case Posale and Gardenshops
Lansanne 1001

17. Various Florishops at various
locations belonging to Migross,
Coop and Private individuals.

The Netherlands

1. Flower Market
Amsterdam

2. Floriade
Hague

3. Auction Hall
Aalsmeer

4. Alexander Lamur
Marco Polostraat
151, 1057 W. B. Amsterdam

5. Klaus Peter Goppner
Representative of Zeutralvverband
Garten bau
Godesterger Allee 142-148, 5300
Bonn 2

APPENDIX III

UNIVERSITIES, INSTITUTION AND COMPANIES ENGAGED IN TISSUE CULTURE OF COMMERCIALLY IMPORTANT PLANTS

Institution	Plant/Crop
Plant Tissue Culture Laboratory Departmment of Microbiology & Cell Biology Indian Institute of Science Bangalore	Rosewood Red sandal wood Cashew
University of Horticulture and Forestry Regional Fruit Research Station Mashobra, Shimla, HP	Apple, Cherry
Department of Botany Utkal University Bhubaneswar Orissa	Orchid
Department of Botany Bangalore University Bangalore	Orchid
All India Coordinated Horticulture Improvement Project *Grape Research Station* Rajendra Nagar Hyderabad	Roses
Biochemistry Division National Chemical Laboratory Pune	Turmeric, Ginger Cardamom
National Botanical Research Institute Lucknow	Bogain Villea, Gladiolus Chrysanthemum, Citrus, Orchids, Amaryllis, Tube Rose Lilium, Petunia
Division of Floriculture and Landscaping IARI New Delhi	Carnation, Rose
Dept. of Applied Botany and Biotechnology Guwahati University Guwahati	Dendrobium
Division of Ornamental Crops Indian Institue of Horticultural Research Bangalore	Orchids Gladiolus, Banana, Anthurium

Department of Horticulture Plant Biotechnology Centre Punjab Agricultural University Ludhiana-141	Mandarins Almonds & Grapes Gladiolus Chrysanthemum
University of Agricultural Sciences GKVK, Bangalore	Tamarind Pomegranate
Division of Fruits and Horticultural Technology IARI, New Delhi	?
Department of Botany Bharathidasan University Tiruchirapalli	Eucalyptus
Centre of Advanced Study Department of Botany Calcutta University Ballygunge Calctta	Orchid
Plant Morphogenesis and Plant Tissue Culture Section Bio-organic Division BARC, Trombay, Bombay	Pineapple
Division of Fruits & Horticultural Technology IARI, New Delhi	Papaya
Department of Botany North East Hill University Shillong	Orchid
Department of Botany University of Punjab Chandigarh	Orchid
Indian Cardamom Research Institute Myladumpura, Kerala	Cardamom
Tissue Culture Division Rashtriya Chemicals & Fertilizers Ltd. Chembur Bombay	Orchids & Medicinal plants
Agrigene Hyderabad	Commercial Unit
Indo-American Hybrid Seeds Bangalore	Commercial Unit
A V Thomas & Co., Ltd., Cochin	Commercial Unit

Hindustan Lever Ltd., Bombay	Commercial Unit
Bio-Tissue Labs Private Limited Hyderabad	Commercial Unit
Unicorn Biotech Ltd.. Hyderabad	Commercial Unit
Hindustan Agri Genetics Hyderabad	Commercial Unit
Microplantech Gurgaon, New Delhi	Commercial Unit
Rashtriya Chemicals and Fertilizers Ltd. Chembur, Bombay	Commercial Unit
SPIC Ltd. Madras	
Parry's Bangalore	Commercial Unit
Agrigene International Highway Home Sanjauli, Shimla	Commercial Unit
Harrisons Malayalam Ltd. Bombay	Commercial Unit

For Further information please contact :

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New Delhi - 110 019
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Telex : (031) - 71209 BCIL IN Email / Intenet : bcil@biotech.ernet.in